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New NASA Payloads

MPTP Face to Face – September 2016

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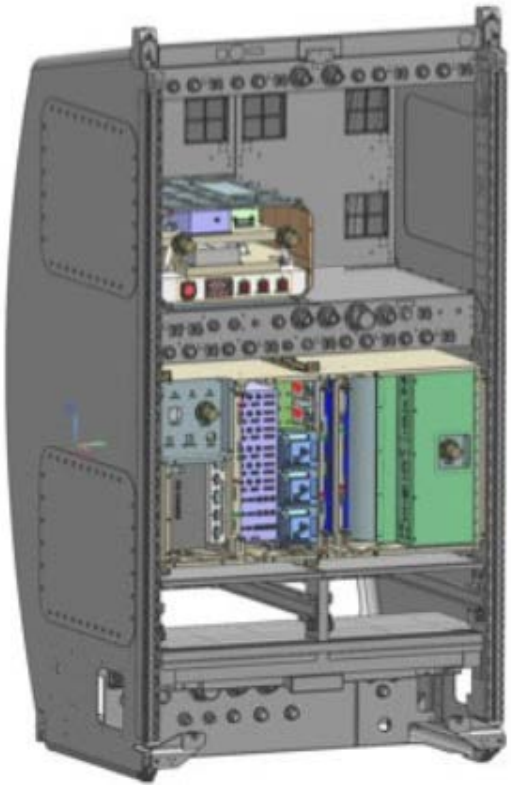
Aerosol Sampling

The Aerosol Sampling experiment will collect airborne particles on the ISS and bring them back to Earth for examination under powerful microscopes to count and size them and determine what they are made of and where they come from.

ISS Aerosol Sampling has 2 types of samples: Active and Passive.

- **For passive sampler arrays (2.006):**
  - There are 7 passive sampler arrays
  - Crew will mount these with at various locations, near filters, with the covers opened
  - Crew will close the covers individually at specified times
  - When the last covers are closed, the crew will remove and stow
- **For active samplers (2.003):**
  - There are 16 active sampler arrays
  - Crew will charge 2 active samplers at a time, load the cartridges, place them in specified locations and allow them to sample unattended
  - After the sample run, the crew will turn off the sampler, remove cartridges and stow
- At the conclusion of all samples being taken, the crew will repack them (active and passive) for return

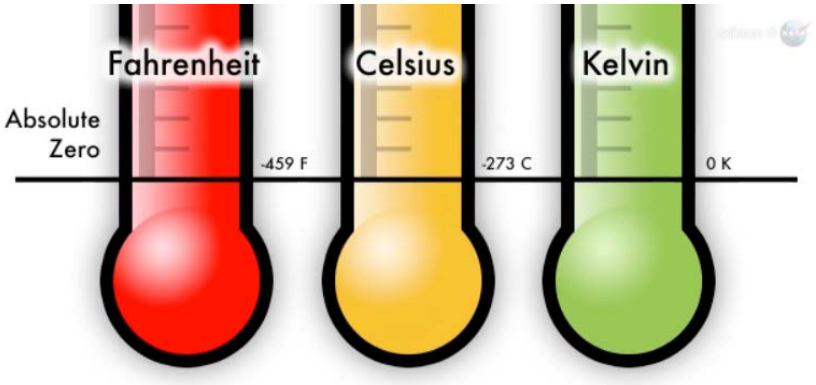
Cold Atom Lab "The Coolest Spot in the Universe"



The microgravity environment of ISS enables the Cold Atom Lab laser cooling technology to reach temperatures colder than ever achieved on earth and to therefore analyze atom wave functions never observed.

- The Cold Atom Lab hardware will be installed in an EXPRESS Rack (as a Subrack Quad and Single Locker) and is planned to operate for the life of the ISS.
- It is powered continuously. Science operations are conducted for 8 hours per day during the crew sleep period to minimize the potential of microgravity disturbances. During the crew wake period (approximately 16 hours per day) the Cold Atom Lab is in a stand-by operational mode.
- CAL is onboard until end of ISS Life.

Mention facility – NTR; ORU OBT



After crew installs and actives payload, the payload operates by ground control. Therefore, no training is required (no special skills or tools are needed for those activities). It was recommended however that some short embedded video clips in the crew procedures would be beneficial for certain steps, e.g., where protective guards for sensitive fiber cables would need to be installed.

FCF Cool Flames

Some types of fuels initially burn very hot, then appear to go out — but they continue burning at a much lower temperature, with no visible flames (cool flames). Understanding cool flame combustion helps scientists develop new engines and fuels that are more efficient and less harmful to the environment. The Cool Flames Investigation provides new insight into this phenomenon, as well as new data on fire safety in space.

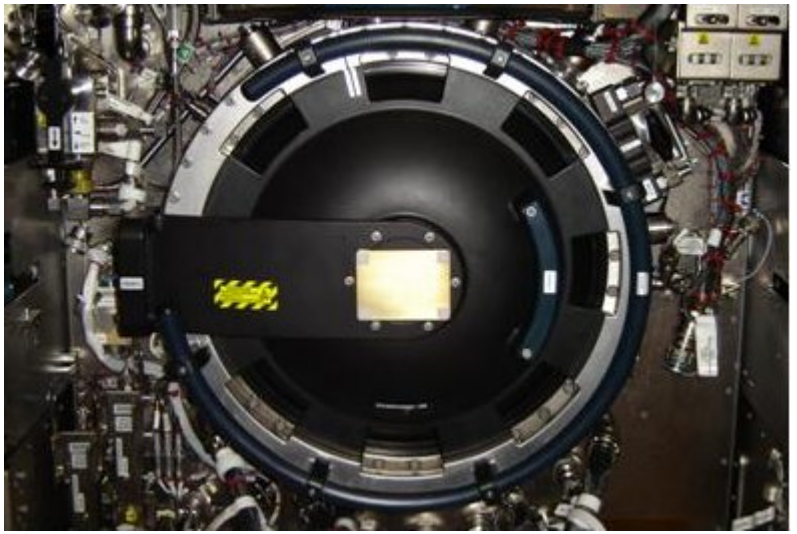
The hardware consists of bottles, fuel reservoirs, a camera system upgrade and an improved radiometer.

Operations:

- Setup and initialization of the CIR rack and MDCA
- Set chamber to appropriate atmosphere
- Dispense fuel droplet
- Retract needles and allow droplet fluid motion to stop
- Initiate power to an igniter
- Capture video, pressure and temperature data for all of the above to verify successful droplet deployment, ignition, and overall progress of the experiment

Cool Flames is part of the NASA/Russia Joint Research program. USOS crews are trained on the entire FCF Rack, FIR and CIR racks – as well as other combustion experiments. Cosmonauts are being trained on support tasks such as bottle change outs and camera inspection.

Fluids and Combustion Facility - Combustion Integrated Rack (FCF-CIR)



Combustion Chamber

Microgravity Expanded Stem Cells

A study on Improved Stem Cell Stem Proliferation resulting in improved stem cell therapy.

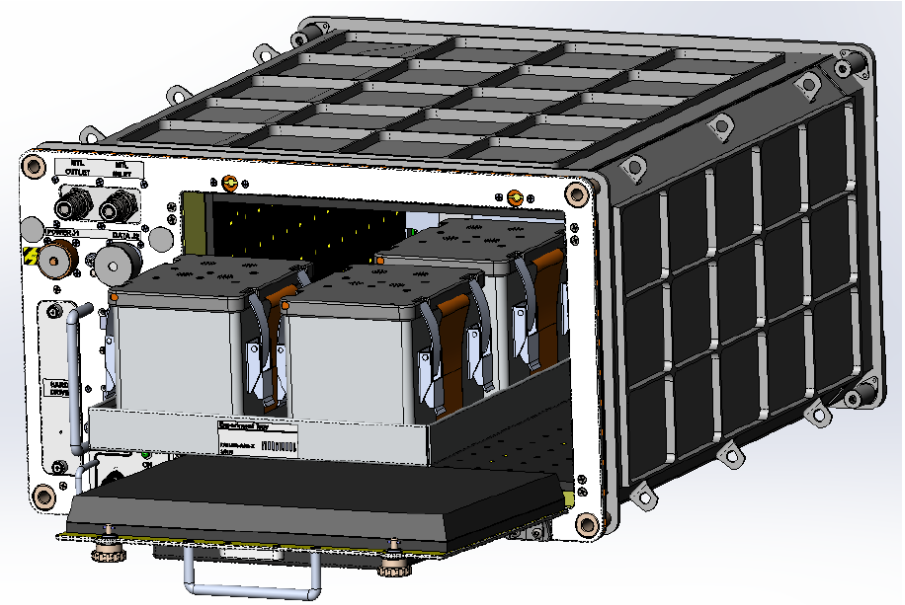
Mesenchymal stem cells will be used for the experiment (*Mesenchymal* cells are able to develop into the tissues of the lymphatic and circulatory systems, as well as connective tissues throughout the body, such as bone and cartilage.)

Objectives

- Measure cell proliferation in microgravity versus ground
- Observe cell growth and morphological characteristics
- Analyze gene expression profiles of cells
- Use viable cells in a variety of downstream in vitro and in vivo experiments on the ground

Fundamental questions

- Can stem cells expand in microgravity?
- Assess feasibility of generating clinical grade stem cells in microgravity
- Evaluate the safety and efficacy of using microgravity expanded stem cells for clinical application



BioCell Habitats in SABL with CO2 control

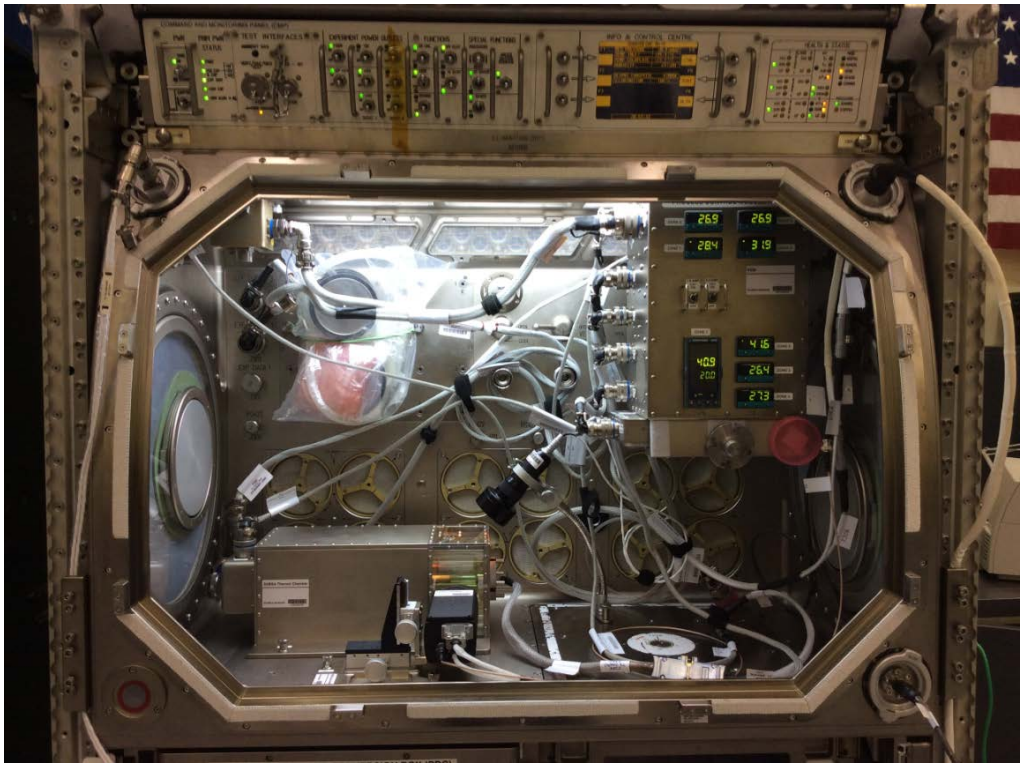
Ops:

- BioCell Habitats and BioCells will be incubated at +37degC
- Fluid exchange operations will be performed in MSG to maintain levels of containment and sterility of the experiment.
- Media exchange
- Microscopy –using Microscope in aisle and MSG VUE system
- Fixation

SUBSA

The Solidification Using a Baffle in Sealed Ampoules (SUBSA) objective is to advance our understanding of the processes involved in semiconductor crystal growth. It offers a gradient freeze furnace for materials science investigations that can reach 850°C. Samples are contained in transparent quartz or ceramic ampoules with high definition video imaging available in real-time along with remote commanding of thermal control parameters.

It was originally operated successfully aboard ISS in 2002 during the MSG rack's first mission increment. SUBSA was refurbished and updated for reflight with modernized software, data acquisition, high definition video, and communication interfaces to ISS and the MSG facility.



The crew will install SUSBA hardware into MSG. SUBSA utilizes the MSG Laptop and SAMS. A camera collects real-time images of the samples as they melt and resolidify. The crew will periodically monitor and change out samples. Images are sent to the ground for the investigator. The investigator sends commands to the experiment, changing temperatures, melt times and other variables that affect sample processing. The imaging system settings can also be adjusted remotely during the processing.

Made in Space Fiber Optics

Made In Space will fly an Optical Fiber payload to demonstrate the scientific and commercial merit of manufacturing exotic optical fiber in microgravity. This experiment will demonstrate the manufacture of materials off the face of the planet. This will fundamentally alter the way the space environment is used to benefit mankind.

The exotic optical fiber chosen for microgravity production is the high value optical fiber, ZBLAN. Research indicates that manufacturing ZBLAN in a microgravity environment significantly improves its performance.

The resulting structure of the material will give data for future materials manufacturing in microgravity.

Made in Space Fiber Optics is a locker sized payload that will need crew time to transfer, install and remove for return. Once installed it will need power and data but no additional crew attention. It will need to operate on orbit for a period of less than 20 days. The process is sensitive to vibration but there is no established standard or limits.

This payload was assessed under the new TST criteria and did not require a TST. Crew Office was notified of this decision.